PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Final Examination: Semester II   Academic Year: 2013

Date: 28 February 2014   Time: 13.30-15.30

Subject: 242-214 การสื่อสารข้อมูล (Data Communications)   Room: Robot

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ทุจริตในการสอบ โทษขั้นต่ำคือ ปรับตกในรายวชาที่ทุจริต และพักการเรียน 1 ภาคการศึกษา

Analoug Transmission   (50 marks)

1. From the picture below, please state what modulation is used for (b), (c), and (d): (15 marks)

Answer

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2. Draw a signal diagram of modulation by using AM (Amplitude Modulation). (5 marks)

Answer

3. Given a bandwidth of 10,000 Hz (1000 to 11,000 Hz), draw the full-duplex ASK diagram of the system. Assume there is no gap between the bands in the two directions. Find a) the carriers and the bandwidths in each direction, b) central frequency of each direction, c) draw frequency usage chart. (10 marks).

Answer

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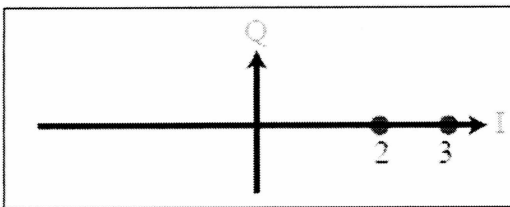...
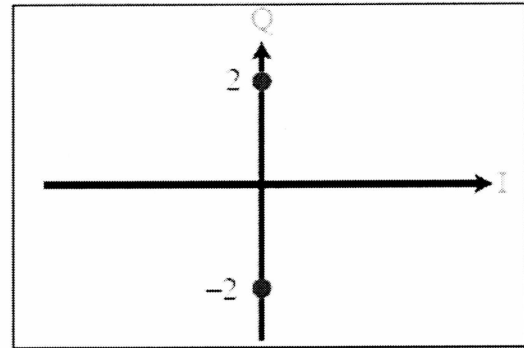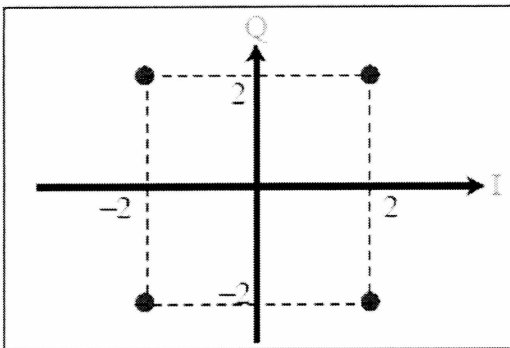
4. Below pictures are constellation diagrams which help us to define the amplitude and phase of a

signal. Please describe what modulation technique is used for each constellation diagram given

below: (20 marks)

a.

b.

c.

d.

Answer

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Error Detection and Correction   (75 marks)

5. Hamming Code can be applied for FEC (Forward Error Correction) technique, as listed below

   Each parity bit calculates the parity for some of the bits in the codeword. The position of the parity bit determines the sequence of bits that it alternately checks and skips.

   Position 1: check 1 bit, skip 1 bit, check 1 bit, skip 1 bit, etc. (1,3,5,7,9,11,13,15,...)

   Position 2: check 2 bits, skip 2 bits, check 2 bits, skip 2 bits, etc. (2,3,6,7,10,11,14,15,...)

   Position 4: check 4 bits, skip 4 bits, check 4 bits, skip 4 bits, etc. (4,5,6,7,12,13,14,15,20,21,22,23,...)

   a. If the original data is 10011110011, what is the (15, 4) codeword after using the Hamming Code? (10 marks)

   b. If the following data is received by the receiver, 100101110011101, is this data corrupted? If yes, what the number of error bits is? (15 marks)

Answer

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Student Name: ……………………………………… Student ID…………………………Section …….

6. Below is a technique of column by column sending scheme. There is 4-bit burst error, and burst error correction is applied by using Hamming code. Please fill in all missing values of codewords received by the receiver. (10 marks)

Sender

0	0	0	1	1	0	1	Codeword 4
0	1	1	0	1	0	0	Codeword 3
1	0	0	0	1	1	0	Codeword 2
1	1	1	1	1	1	1	Codeword 1

Receiver

Codeword 4	0	0	0	1		0	1
Codeword 3	0	1	1	0		0	0
Codeword 2	1	0	0		1	1	0
Codeword 1	1	1	1		1	1	1

Burst error

A data unit in transit: 0 0 1 1 0 1 0 1 0 1 0 1 1 0 1 0 0 0 1 1 0 0 1 1 1 0 0 1

Corrupted bits

Answer

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7. The below picture shows one cyclic redundancy check using a shift register circuit. Please fill in each shift register value in each clock stage, and the remainder, if the codeword received is 1001000 (most significant bit is on the far left) (20 marks)

Encoder for $g(x) = x^3 + x + 1$

$0,0,0,i_0,i_1,i_2,i_3$

$g_0 = 1$ $g_1 = 1$ $g_3 = 1$

Reg 0   Reg 1   Reg 2

Clock	Input	Reg 0	Reg 1	Reg 2
0	-			
1	i_3			
2	i_2			
3	i_1			
4	i_0			
5	0			
6	0			
7	0			
Check bits:		$r_0 =$	$r_1 =$	$r_2 =$

Answer

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8. Below is checksum from the sender side. Please show checksum at the receiver side (10 marks)

1	0	1	3		Carries
	4	6	6	F	(Fo)
	7	2	6	7	(ro)
	7	5	7	A	(uz)
	6	1	6	E	(an)
	0	0	0	0	Checksum (initial)
	8	F	C	6	Sum (partial)
				1	
	8	F	C	7	Sum
	7	0	3	8	Checksum (to send)

Answer

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9. Suppose a message is sent and a single bit error occurs. What bit number is error in the given picture below (show how you get the value). (10 marks)
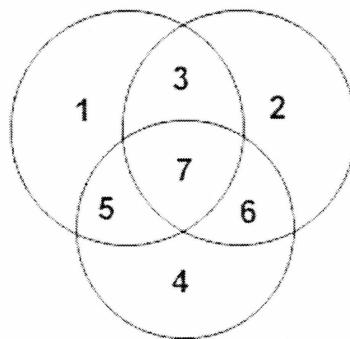
Bit positions:
Blue is parity bit number
Red is data bit number
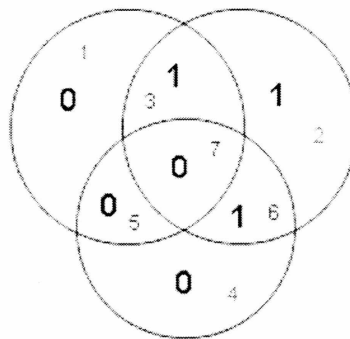
Bit value in codeword:
Blue is parity bit number
Black is data bit value
Red is data bit number

Answer

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Multiplexing (65 marks)

10. (a) What is statistical multiplexing? (5 marks)
    (b) Why does it differ from conventional multiplexing? (5 marks)

    (c) What are the advantages of the statistical MUX compared to the convention MUX? (5

marks)

Answer

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11. (a) What is the difference between circuit switching and packet switching? (b) What are the advantages and disadvantages of packet switching (compared to circuit switching)? (10 marks)

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12. Two offices are communicating using TDM; four 2-Kbps connections are multiplexed together. A unit is 1 bit. Find
(a) the duration of 1 bit before multiplexing, (5 marks)

(b) the transmission rate of the link, (5 marks)

(c) the duration of a time slot, and (5 marks)

(d) the duration of a frame (5 marks).

Answer

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13. Four data channels (digital), each is with 1 Mbps, use a satellite channel of 1 MHz. Design an appropriate configuration, using FDM. (10 marks)

Answer

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14. The figure shows synchronous TDM with 4 1Mbps data stream inputs and one data stream for the output. The unit of data is 1 bit. Please use all information appeared in the figure to answer the following questions: (20 marks)

1. The input bit duration.
2. The output bit duration,
3. The output bit rate,
4. The output frame rate.

Answer

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Part II

เลือกคำตอบที่ถูกที่สุดเพียงข้อเดียว (เลือกมากกว่า 1 ข้อ คะแนน -1 หากคำตอบถูกได้ 2 คะแนน หากตอบผิดได้ -1 คะแนน

1. What is this step called in voice processing?
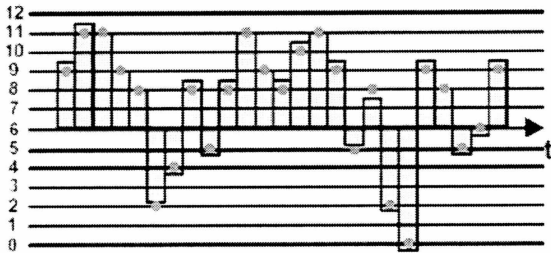
   a) Digitization
   b) Quantization
   c) Sample and Hold
   d) Analog to digital conversion
   e) Digital to Analog conversion

2. What is the command signal in step 2?
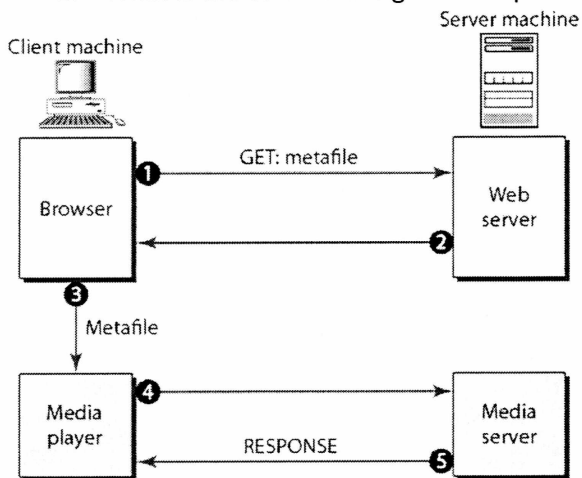
   a) Setup
   b) Response
   c) Play
   d) Pause
   e) Get: audio/video file

3. What is the command signal in step 4
   a) Setup
   b) Response
   c) Play
   d) Pause
   e) Get: audio/video file

4. Which one is true for G.711 audio codec?
   a) Bit rate is 64 kbps
   b) There are 2 sub-version: u-Law and A-law
   c) Sampling rate is 8 kbps
   d) Sampling size is 8 bits
   e) All of above
5. Which one is the advantage of G.723 over G.711
   a) Lower bit rate
   b) Sample size is bigger
   c) More delay in packetizing
   d) Need low bandwidth
   e) All of above

6. Below is a video process. What is (A)?

Three phases of JPEG
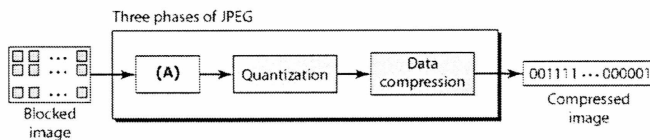
   a) Discrete Cosine Transform (DCT)

   b) Pulse code modulation (PCM)

   c) Video codec

   d) Analoug to digital conversion

   e) No correct answer

7. Below is MPEG process. What is (A)?
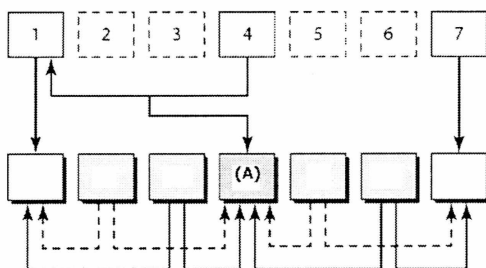
   a) I-frame

   b) B-frame

   c) P-frame

8. Which one is NOT a SIP message?

   a) Invite

   b) Response

c) Bye

d) Option

e) Register

9. Below is SIP signal flow. What is signal (A) called?
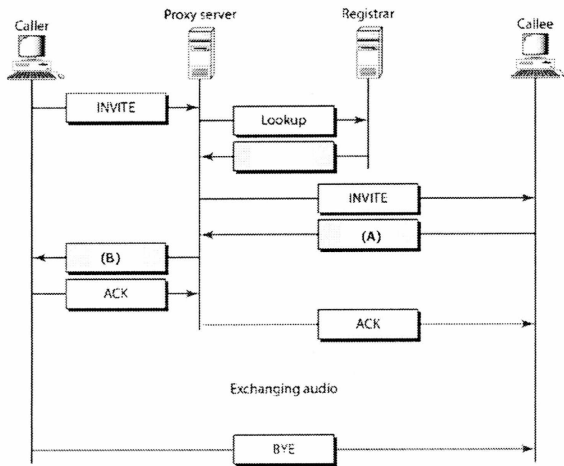
a) Register

b) Response

c) OK

d) Option

e) Ack

10. What is signal (B) called?

a) Register

b) Response

c) OK

d) Option

e) Ack

11. We have an available bandwidth of 100 kHz which spans from 200 to 300 kHz. What is the bit rate if we modulated our data by using ASK with d = 1, r=1?

a) 10 kbps

b) 25 kbps

c) 50 kbps

d) 100 kbps

e) 500 kbps

12. An analog signal carries 4 bits per signal element. If 1000 signal elements are sent per second, find the bit rate. If each signal element carries one bit information.

a) 1000 kbps

b) 2000 kbps

c) 4000 kbps

d) 5000 kbps

e) No correct answer

13. What do we call the multiplexing scheme given below?
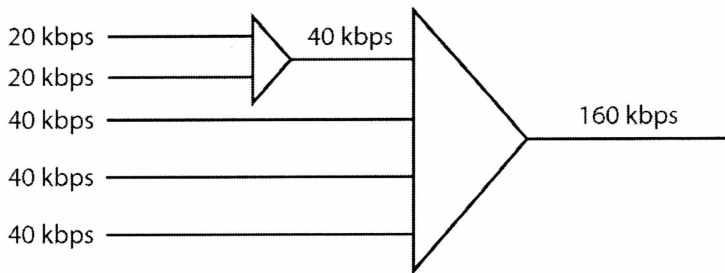
a) Multilevel

b) Multislot

c) Pulse stuffing

d) Bit interleaving

e) Byte interleaving

14. What is a missing box?
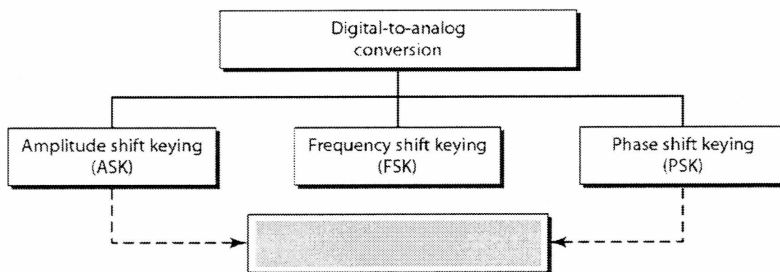
a) PAM

b) QAM

c) WDM

d) DWDM

e) No correct answer

15. In H.323 service, what (A) is called?
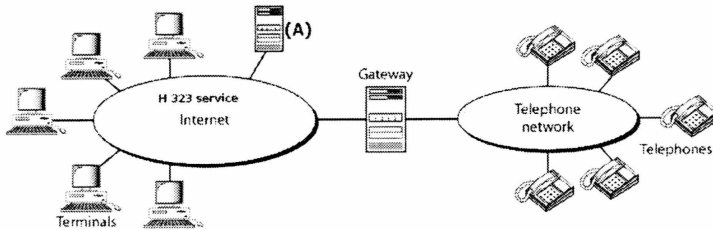
a) H.323 server

b) Gatekeeper

c) Domain Name server

d) Registration server

e) H.323 Gateway

16. Below is H.323 protocol usage. What is (A) protocol?

Audio			Control and signaling	
Compression code RTP	RTCP	H.225	Q.931	H.245
			(A)	
IP				
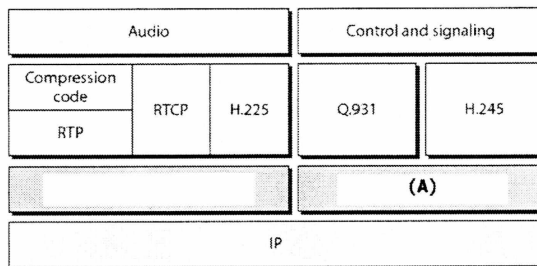
a) TCP

b) UDP

c) RTP

d) RTSP

e) HTTP

Part III

ให้ตอบ T หากข้อความถูกต้อง ตอบ F หากข้อความไม่ถูกต้อง ตอบถูกได้ 1 คะแนนตอบผิดได้ -1 คะแนน

1. [___] We can send analogue and digital signals directly over a medium.
2. [__] The process of taking a group of bits from each input line for multiplexing is called interleaving.

3. [__] To ensure that the receiver correctly reads the incoming bits, i.e., knows the incoming bit boundaries to interpret a "1" and a "0", a known bit pattern is used between the frames. These bits (or bit patterns) are called signal element bit(s).
4. [__] The bandwidth usage by FM is higher than for AM
5. [___] Streaming stored audio/video refers to the broadcasting of radio and TV programs through the Internet.
6. [___] Spatial samples is the digital value of sampling points in a video frame.
7. [___] The picture quality of video is depended on the temporal sampling rate or frame rate.
8. [__] P-frame contains only the changes from the preceding frame.
9. [__] Spread spectrum is a communication technique that spreads a narrowband communication signal over a wide range of frequencies for transmission
10. [__] Spread Frequency Hopping Spread Spectrum (FHSS) gives a better performance than DSSS (Direct Sequence Spread Spectrum)